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EFFECT OF ORGANIC MANURES ON FLOWER YIELD OF AFRICAN MARIGOLD *(TAGETES ERECTA L.)* CV. PUSA NARANGI GAINDA

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ABSTRACT

The present investigation entitled **Effect of Organic manures on flower Yield of African Marigold *(Tagetes erecta L.)* CV. Pusa Narangi Gainda** was undertaken at Department of Horticulture, Sam Higginbottom Institute of Agriculture Technology & Sciences. Allahabad, during the year 2012-2013. The experiment was laid out in R.B.D. with three replications and nine treatments separately. Studies showed that, significant effect on fresh weight of flower (9.20gm), (number of flowers per plant (39.75), flower yield per plant (366.02g), flower yield per plot (3.29kg), flower yield per hectare (32.94 t ha-1), maximum gross return (Rs. 329,418 t ha-1), net return (Rs 238,549) and cost of benefit ratio (3.63) was recorded maximum in treatment with T7 (poultry manure) under Allahabad agro climatic conditions.

KEYWORDS: *Tagetes erecta* L., Flower Yield, Organic Manures

INTRODUCTION

African Marigold (*Tagetes erecta* L.) cv. Pusa narangi belongs to family Asteraceae is one of the most commonly grown loose flower and use extensively on religious and social functions in different forms [**1**]. African Marigold flowers has attractive range of colours for a considerably prolonged period and the flowers can be kept remarkably well when cut. Sometimes, the whole plant can be used for decorations. They can be planted in beds for mass display, in mixed borders and can also be grown in pots **[2].**

Marigold is a native of Central and South America especially Mexico. The generic name *Tagetes* is derived from, "*Tages*", the name of Estrucsch God, known for his beauty. French was the first to apply the name *Tagetes*, which was later adopted by others **[3**]. Marigold were domesticated and used as an ornamental plant during pre-Columbian period before they were introduced in Europe and South Asia including India.

Apart from its significance in ornamental horticulture it has been valued other purposes too. *Calendula* flowers are used medicinally as an anti-inflammatory, an anti-tumor agent, and a remedy for healing wounds **[4].** Plant pharmacological studies have suggested that Calendula extracts have anti-viral, anti-genotoxic, and anti-inflammatory properties in-vitro [**5].** In herbalism, *Calendula* in suspension or in tincture is used topically for treating acne, reducing inflammation, controlling bleeding, and soothing irritated tissues [**6]** and [**7].** There is limited evidence that *Calendula* cream or ointment is effective in treating radiation dermatitis [**8].** Topical application of *Calendula officinalis* ointment has helped to prevent dermatitis, pain, and missed radiation treatments in randomized trials [**7].** *Calendula* has been used traditionally for abdominal cramps and constipation [**9].** In experiments with rabbit jejunum the aqueous-ethanol extract of *Calendula officinal* flowers was shown to have both spasmolytic and spasmogenic effects, thus providing a scientific rationale for this traditional use [**9].** An aqueous extract of *Calendula* officinal is obtained by a novel extraction method has

demonstrated anti-tumor (cytotoxic) activity and immunomo-dulatory properties (lymphocyte activation) in vitro, as well as anti-tumor activity in mice **[5].** *Calendula* is known to cause allergic reactions It should be avoided during pregnancy.

The aromatic oil extracted from *Tagetes minuta* which is being treaded as "Tagetes oil" as fly repellent and has also got larvicidal properties it also being grown as trap crop in agriculture against some of lepidopterans, coleopterans and nematodes **[10]** and **[11]**.

Marigold is growing today as commercially important source of carotinoid pigments. The principal pigment present in the flowers is xanthophyll, particularly lutien accounts for 80 to 90 percent in the form of esters of plamitic and myristic acid [**12**]. The ground blossom meals (petal meal) or the extract usually saponified for better absorption is added to the poultry feed. These products are trade as "Aztec marigold" or marigold extract as "Adoptinal". In India, the present area under marigold cultivation is 28,825 hectares with a production of more than 2.0 metric tons [**13**]. It is cultivated commercially in most parts of India. Karnataka alone occupies 6725 hectares with an annual production of 64,025 tones **[13]**. Presently in India the commercial extraction of marigold carotenoids is done in Cochin, Hyderabad (Andhra Pradesh) near Satyamangalam and forest (Tamil Nadu) and Telagi near Harihar, Devanagere, Haveri, Kolar, Chikkmagalore district and around Bangalore (Karnatka). The contents are regularly exported to Mexico, Peru, USA, Japan, Spain, Turkey, Poland, Italy, Australia, Canada, and Africa.

In India, *Tagetes erecta* & *Tagetes patula* are under commercial cultivation for cut flowers, but premium prices are for *Tagets crecta*. Different varieties of African Marigold vary in plant height and spread, flower size, quality and yield **[14]**. The flowers are large and globular in shape. Colour shades vary from light yellow to creamy yellow, bright yellow, cadmium orange, deep orange, sulphur, yellow and white. The chromosome number of African marigold is 2n = 24.

In India, there is tremendous potential for the cultivation and use of ornamental plants and flowers because of their importance and potentiality and therefore in floriculture cultivation of this flower is receiving much attention in many countries. But the firm foundation on which this ornamental flower can be built up as an industry has to be supplied by well planned research and experimentation.

West Bengal with wide agro-climatic diversity is the leading state for commercial cultivation of loose flowers **.** Among the most important commercial flower which is grown on large scale for loose flowers mainly in the district of Midnapore, Howrah, Hooghly, 24 Parganas and Nadia.

Some of the commercial varieties of African marigold (*Tagetes erecta*) group are Gaint Double African Orange, Giant Double African Yellow, Pusa Narangi Gainda and Pusa Basanti Gainda. Success in any crop breeding programme depend on the availability of genetic diversity. Generally varieties can be found in both domesticated and naturalized habitats in the form of local landraces, modern varieties as well as wild strains **[15]**.

Agriculture, which largely depends on chemical fertilizers, pesticides herbicides etc, though resulted in increased production, has adversely affected the soil productivity and environmental quality. The heavy use of chemical fertilizers, pesticides and fungicides caused health hazards and environmental pollution now-a-days the organic farming is gaining great importance. The word organic means, origin from living things and with organic farming to make production system alive with a long life. It is similar to other sustainable farming systems, viz., permaculture, eco farming, etc., which are based on harmony with nature or near to the natural approach. Long term fertilizer experiments have made clear the negative impacts of continuous use of chemicals on soil health **[16]**.

Consequently, many farmers are seeking alternative practices like organic farming such as poultry manure, farm

yard manure, vermicompost and compost to make crop cultivation sustainable. Organic farming is not mere non-chemical agriculture, but it is a system integrating relations between soil, plant and water. Organic farming helps in soil health, proper energy flow in soil, crop, water environment systems, keeps biological life cycle alive and helps in sustaining considerable levels in yield **[17].** It is mainly based on principles of restoration of soil organic matter in the form of humus, increasing microbial population, skilful application of the factors contributing soil life and health and treating manures in bio-dynamic way **[18].** Application of organics which is an important component in organic farming, apart from improving the soil physical, chemical and biological properties with direct impact on moisture retention, root growth and nutrient conservation, can also reduce the cost of production in agriculture. Keeping these benefits points in view an investigation was carried out to find out the **"Effect of organic manures on, flower yield of African marigold (*Tagetes erecta* L.)" cv. Pusa Narangi Gainda** with the following objectives:

- To find out the most suitable manuring for flower yield of African marigold.
- To work out the economics of different treatments.

MATERIALS AND METHODS

A field experiment entitled **"Effect of organic manures on flower yield of African marigold (*Tagetes erecta* L.)" cv. Pusa Narangi Gainda** was carried out at horticultural Experimental Field, Department of Horticulture, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Deemed-to-be University, (Formerly known as Allahabad Agricultural Institute), during rain season of 2012. The details pertaining to the materials and methods adopted are presented in this chapter. Raised nursery beds of 3.0 x 1.0 m were prepared thoroughly. Then the seeds were sown on 12-6-2012 during rain season .The nursery beds were maintained systematically upto 45 days till the seedlings were ready for transplanting. Experimental plot was ploughed one month before planting of seedling. After that three harrowing were given in order to bring the land to a fine tilth. On 2 July, 2012 the experimental area was laid out in flat beds of size (1x1m) well decomposed manures were applied twenty days prior to the transplanting seedling at the rate of the (1and2) kg/m^2 according to treatment and mixed well in the soil. Irrigation was given to the plots two days prior to the transplanting of the seedlings. So that seedlings could be transplanted in well moist soil. Seedlings of Marigold were transplanted in the main field when they had 2-3 true leaf stage on 27 July 2012. During the transplanting soil was pressed firmly around the seedlings so that seedlings will not be disturbed by irrigation water immediately after transplanting. The organic manures (FYM, Poultry manure, Compost, and Vermicompost) were applied manually before twenty days from planting, applied in each plot according to treatments. also NPK were applied with rate 100 -100- 100 Kg Half dose of N and total dose of P2O5 and K2O were applied as basal dose one week before transplanting. The second dose N was applied as top dressing at 30 DAT. and well mixed with the soil to all treatments.

Details of Layout

Crop	:	Marigold
Cultivar	:	Pusa Narangi Gainda
Design of experiment	:	Randomized Block Design (RBD)
No. of replications	:	3
No. of treatment	:	9
Total no. of plots	:	27

Size of plots	:	1.m x 1.m
Area of single plot	:	1.0 m^2
Length of experiment field	:	12.60 m
Width of experiment field	:	5.00 m
Gross area of experiment field	:	63.00 m
Width of main irrigation channel	:	1.00 m
Width of sub irrigation channel	:	0.05 m
Spacing plant to plant	:	30cm
Total no. of plants/plot	:	9
Total no. of plants in field	:	243
Net cultivated	:	2 3 m^2

Treatment Details

Table 1

S. No.	Treatment Details	
1.	T_1	Control
2.	T_2	farmyard manure (FYM)10 t/ha
3.	T_3	farmyard manure (FYM)20 t/ha
4.	T_4	Compost 10 t/ha
5.	T_5	Compost 20 t/ha
6.	T_6	Poultry manure 10 t/ha
7.	T_7	Poultry manure 20 t/ha
8.	T_8	Vermi compost 10 t/ha
9.	T_9	Vermi compost 20 t/ha

RESULTS AND DISCUSSIONS

The present investigation was aimed at identifying suitable organic manures treatment for Marigold cultivation with respect to productivity and quality of cut flowers. Nine organic manures treatments, including control, were evaluated during the rainy season 2012 in the experimental unit of Department of Horticulture, Allahabad school of Agriculture Sam Higginbottom Institute of Agriculture, Technology and sciences, Allahabad the results of the experiment have been presented separately under the following headings.

Number of Flowers per Plant

The different treatment of organic manures significantly affected the number of flowers per plant. It is evident from table 3 that among the different treatment, the maximum number flowers39.75 were recorded with T_7 Poultry manure 20 t/ha followed by T_3 FYM 20 t/ha 36.67, T_9Vermi compost 20 t/ha 34.33. The minimum number of flowers per plant was recorded with T_1 Control 22.15.

These results are in accordance with the results obtained by **[19]** in (marigold), **[20]** in (tuberose). Similarly with [**21]** in (marigold). Also similar result with **[22]** in (marigold), **[23]** in (marigold) and **[24]** in (marigold).

Fresh Weight of Flower (g)

It is evident from ANOVA table that the weight of single flower was greatly significantly influenced by the different treatments of organic manure. It is clear from the table 4 that the maximum weight of flower was recorded T_7 Poultry manure 20 t/ha 9.20 followed by T_3 FYM 20 t/ha 8.85 and T_9 Vermi compost 20 t/ha8.75 and T_5 Compost 20 t/ha 8.61 respectively. Treatment T_1 Control recorded with its minimum weight of 7.61.

Similar findings were obtained by [**22]** in (marigold), **[25]** In (china aster**)** These results are also similar with **[26]** in (marigold)**, [27]** in (marigold**)** and **[28]** in (marigold).

Flower Yield Plant^{-1} (g)

The statistically analysis of the data on flower yield per plant of marigold found to be significant the mean of flower yield per plant.

The maximum flower yield per plant (g) T_7 Poultry manure 20 t/ha 366.02 (g) followed by T_3 FYM 20 t/ha 324 (g) and T_9 Vermi compost 20 t/ha 300.36 (g). where as minimum flower yield per plant was 168.58 (g) recorded treatment T_1 Control.

Similar results were reported by **[28]** in (marigold) **,[19]** in (marigold), [**20]** in (tuberose) Similarly with **[21]** in (marigold). also Similar result with **[22]** in (marigold) and [**26]** in (marigold).

Flower Yield per Plot $^{-1}$ (kg)

From the analysis of data presented as enumerated in table 6 and graphically figure presented in table 3 it is observed that treatment T_7 Poultry manure 20 t/ha gave highest flower per plot (3.29 kg) followed by T_3 FYM 20 t/ha which gave (2.92kg) and T_9 Vermi compost 20 t/ha which gave (2.70kg) minimum while recorded with treatment T_1 (Control) which gave (1.52kg).

Similar results were reported by **[28]** in (marigold**), [19]** in (marigold), [**20]** in (tuberose) Similarly with **[21**] in (marigold) also Similar result with **[22]** in (marigold) and **[26]**. In (marigold)

Flower Yield (t ha^{-1})

From the analysis of the observed data presented as enumerated in table 7 gave highest flower yield (32.94 t ha^{-1}) followed by T_3 FYM 20 t/ha which gave (29.22 t ha^{-1}) and T_9 Vermi compost 20 t/ha which gave (27. 03 t ha^{-1}) while minimum was recorded with treatment T_1 (Control) while gave (15.17 t ha^{-1}).

Similar results were reported by **[28]** in (marigold)**, [19]** in (marigold), [**20]** in (tuberose) similarly with [**21]** in (marigold). also Similar result with **[22]** in (marigold) and **[26]** in (marigold).

DISCUSSIONS

Plant nutrients supplied through organic sources had profound effect on growth and productivity of the crop either by acceleration of respiratory process with increasing cell permeability and hormonal growth action or by combination of all these processes. Through their biological decomposition processes the organic sources supply nutrients to the plants in the available form. They are also rich in micro nutrients besides having plant growth promoting substances viz., hormones, enzymes and humus forming beneficial microbes. Organic sources, on application to the soil, improve the physical properties of soil such as aggregation, aeration, permeability and water holding capacity **[29]** which promote growth and development of plants. It has been reported that among the organic sources of nutrients, poultry manure proved to be the

best source of organic manure which helped in improving physico-chemical properties (pH, EC, organic carbon, macro and micro nutrients) of soil because of its higher analytical values **[30].** It contained 2.00, 1.97, 4.92% NPK, respectively and 113.2, 71.0, 140.6 and 310.5 mg/kg of total zinc, copper, iron and manganese, respectively **[31].**

It has also been experimentally proved that considerable amount of N present in poultry manure consist of uric acid, which is readily available to the plants. The C: N ratio of poultry manure reported to be narrower than others, which attenuates the release of nitrogen **[32].**

Poultry manure when supplied to soil improves texture makes soil loose increase water holding capacity and uplift humus status which maintain the optimum conditions for microorganism activity. since T7 is supplied with poultry manure .therefore the treatment T7 gives better result in all, flowers yied.

CONCLUSIONS

On the basis of the present investigation aimed to identify suitable organic manures treatment for Marigold (*Tagetes erecta* L.)" cv. Pusa Narangi Gainda with respect to productivity during the rainy season 2012, it is concluded that the application of treatment T_7 (Poultry manure 20 t ha^{-1}) gave maximum flower yield (32.94 t ha^{-1}). The treatment T_7 was found to be most economically viable in terms of gross return, net return and benefit cost ratio (3.63). However, since the results are obtained only from one season further investigations need to be done before recommending.

Table 2 : Number of Flowers $Plant^{-1}$ of Marigold (*Tagetes erecta* L.) as Influenced by Different Organic Manures

Treatment No.	Treatment	Number of Flowers $Plant^{1}$
T_1	Control	22.15
T_2	Farmyard Manure (FYM) @ 10 t ha^{-1}	28.00
T_3	Farmyard Manure (FYM) @ 20 t ha^{-1}	36.67
T_4	Compost @ 10 t ha^{-1}	25.53
T_5	Compost @ 20 t ha^{-1}	32.07
T_6	Poultry Manure (PM) @ 10 t ha^{-1}	29.20
T_7	Poultry Manure (PM) @ 20 t ha^{-1}	39.75
T_8	Vermicompost (VC) @ 10 t ha^{-1}	26.13
T_9	Vermicompost (VC) @ 20 t ha^{-1}	34.33
	F - test	S
	S. Ed. (±)	0.60
	C. D. (P = 0.05)	1.26

Table 3 : Fresh Weight of Flower (g) of Marigold (*Tagetes erecta* L.) as Influenced by Different Organic Manures

Treatment No.	Treatment	Weight of Flower (g)
T_1	Control	7.61
T_2	Farmyard Manure (FYM) @ 10 t ha^{-1}	8.25
T_3	Farmyard Manure (FYM) @ 20 t ha^{-1}	8.85
T_4	Compost @ 10 t ha^{-1}	7.89
T_5	Compost @ 20 t ha^{-1}	8.61
T_6	Poultry Manure (PM) @ 10 t ha^{-1}	8.39
T_7	Poultry Manure (PM) @ 20 t ha^{-1}	9.20
T_8	Vermicompost (VC) @ 10 t ha^{-1}	8.11
T_9	Vermicompost (VC) @ 20 t ha^{-1}	8.75
	F - test	S
	S. Ed. (±)	1.96
	C. D. (P = 0.05)	0.89

Table 4 : Flower Yield Plant^{-1} (g) of Marigold (*Tagetes erecta* L.) as Influenced by Different Organic Manures

Treatment No.	Treatment	Flower Yield Plant^{-1} (g)
T_1	Control	168.58
T_2	Farmyard Manure (FYM) @ 10 t ha^{-1}	231.11
T_3	Farmyard Manure (FYM) @ 20 t ha^{-1}	324.64
T_4	Compost @ 10 t ha^{-1}	201.37
T_5	Compost @ 20 t ha^{-1}	276.20
T_6	Poultry Manure (PM) @ 10 t ha^{-1}	244.92
T_7	Poultry Manure (PM) @ 20 t ha^{-1}	366.02
T_8	Vermicompost (VC) @ 10 t ha^{-1}	211.93
T_9	Vermicompost (VC) @ 20 t ha^{-1}	300.36
	F - test	S
	S. Ed. (±)	6.36
	C. D. (P = 0.05)	13.48

Table 5 : Flower Yield Plot^{-1} (kg) of Marigold (*Tagetes erecta* L.) as Influenced by Different Organic Manures

Treatment No.	Treatment	Flower Yield Plot^{-1} (kg)
T_1	Control	1.52
T_2	Farmyard Manure (FYM) @ 10 t ha^{-1}	2.08
T_3	Farmyard Manure (FYM) @ 20 t ha^{-1}	2.92
T_4	Compost @ 10 t ha^{-1}	1.81
T_5	Compost @ 20 t ha^{-1}	2.49
T_6	Poultry Manure (PM) @ 10 t ha^{-1}	2.20
T_7	Poultry Manure (PM) @ 20 t ha^{-1}	3.29
T_8	Vermicompost (VC) @ 10 t ha^{-1}	1.91
T_9	Vermicompost (VC) @ 20 t ha^{-1}	2.70
	F - test	S
	S. Ed. (±)	0.06
	C. D. (P = 0.05)	0.12

Table 6 : Flower Yield t ha^{-1}) of Marigold (*Tagetes erecta* L.) as Influenced by Different Organic Manures

Treatment No.	Treatment	Flower Yield (t ha^{1})
T_1	Control	15.17
T_2	Farmyard Manure (FYM) @ 10 t ha^{-1}	20.80
T_3	Farmyard Manure (FYM) @ 20 t ha^{-1}	29.22
T_4	Compost @ 10 t ha^{-1}	18.12
T_5	Compost @ 20 t ha^{-1}	24.86
T_6	Poultry Manure (PM) @ 10 t ha^{-1}	22.04
T_7	Poultry Manure (PM) @ 20 t ha^{-1}	32.94
T_8	Vermicompost (VC) @ 10 t ha^{-1}	19.07
T_9	Vermicompost (VC) @ 20 t ha^{-1}	27.03
	F - test	S
	S. Ed. (±)	0.57
	C. D. (P = 0.05)	1.21

Table 7

Table 4.15.3 Economics of different treatments and benefit cost ratio of Marigold (*Tagetes erecta* L.)

Treatment No.	Treatment	Flower yield t ha^{-1}	Selling rate Rs. t^{-1}	Gross return Rs. ha^{-1}	Cost of cultivation Rs. ha^{-1}	Net return Rs. ha^{-1}	Benefit cost ratio
T_1	Control	15.17	10,000	151723.74	71,789	79935.24	2.11
T_2	Farmyard Manure (FYM) @ 10 t ha^{-1}	20.80	10,000	207998.40	78,149	129849.90	2.66
T_3	Farmyard Manure (FYM) @ 20 t ha^{-1}	29.22	10,000	292176.00	84,509	207667.50	3.46
T_4	Compost @ 10 t ha^{-1}	18.12	10,000	181232.40	82,389	98843.90	2.20
T_5	Compost @ 20 t ha^{-1}	24.86	10,000	248580.00	92,989	155591.50	2.67
T_6	Poultry Manure (PM) @ 10 t ha^{-1}	22.04	10,000	220428.00	81,329	139099.50	2.71
T_7	Poultry Manure (PM) @ 20 t ha^{-1}	32.94	10,000	329418.36	90,869	238549.86	3.63
T_8	Vermicompost (VC) @ 10 t ha^{-1}	19.07	10,000	190737.60	87,689	103049.10	2.18
T_9	Vermicompost (VC) @ 20 t ha^{-1}	27.03	10,000	270321.60	103,589	166733.10	2.61

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